

DETERMINANTS OF CAPITAL STRUCTURE IN NORDIC COUNTRIES

Firm-level and Country-level factors on leverage ratio

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Abstract

This paper aims to examine the factors affecting the choice of capital structure for publicly listed firms in four Nordic countries including Denmark, Finland, Norway and Sweden over the period 2004 – 2017. The result of the investigation into firm-specific determinants on the capital structure shows that tangibility and firm size have a significant positive relationship with long-term debt ratio for public firms in most of Nordic countries, except for Finland. On the other hand, profitability is negatively correlated with leverage ratio in all four countries; meanwhile, growth opportunity yields a mixed result: there is a significant negative relationship for Finnish public firms and a significant positive relationship for Danish public firms. Liquidity and Non-debt tax shields have no significant impact on leverage for most of Nordic countries, except for Finland in terms of liquidity and Sweden in terms of non-debt tax shields. Business risk shows a significant negative relationship with leverage ratio in Norway and Sweden. Moreover, by decomposing the sample set into different industrial categories, I find that there is evidence for the existence of industrial effect on firm-specific determinants, as the impact of those determinants on leverage ratio is different in different sectors.

The result of the investigation into country-specific effects shows that GDP growth rate and the development of the stock market have a significant negative correlation with long-term debt ratio. On the other hand, the estimation results show that the development of the banking industry, the development of the bond market, and the inflation rate have no significant impact on capital structure decision for public firms in the Nordic region. These results may imply that Nordic firms in general prefer equity financing to debt financing, and when it comes to debt financing decision these firms prefer corporate bonds to bank loans.

Keywords determinants, capital structure, Nordic, Denmark, Finland, Norway, Sweden

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1 Introduction

In the past years, formation of the capital structure and how it could be utilized to maximize the value of public firms has been an important research topic that there are several studies by economists and researchers to examine the impact of different factors on the capital structure. On the one hand, public firms theoretically could take advantage of tax shields from debt repayment to maximize their value. On the other hand, public firms, however, could find it difficult to service their debt obligation if the adopted level of debt is too high. High level of debt could also bring along a higher risk of bankruptcy and also different types of financial distress. Therefore, from the point of view of the static trade-off theory, public firms always strive to balance the benefits and the costs of debts, and seek to the optimal capital structure formation to maximize their value. However, from the point of view of the pecking order theory, unlike what static trade-off theory suggested, in general public firms are more likely to prefer internal financing to external financing, and in case of external financing, firms may seek to the safest security first, which includes convertible bonds, different types of debts. According to the theory, equity issues are considered as a last resort when it comes to financing decision made by public firms. Both theories were developed based on the theoretical foundation of Modigliani and Miller's (1958) propositions which argued that the value of public firms is unaffected by the choice of capital structure.

Existing literature for a long time has studied the impacts of different determinants on the capital structure of public firms in several countries and regions. Although most of the studies used Modigliani and Miller theorem, static trade-off theory, pecking order theory and agency cost as their theoretical foundation, these studies, however, often yielded a mixed result about the impacts of determinants on the capital structure. One of the reasons for the inconsistent results may be because different authors adopted different measurement and regression method in their research. Another explanation may be because for different countries, the impact of determinants on capital structure is different due to the existence of country effect and industrial effect. The impact of these two factors will be further discussed in this paper.

On the other hand, while these studies mostly focused on investigating the impacts of different determinants on the capital structure of public firms in the United States and in other developed European countries, it is quite uncommon to see any papers examining those impacts exclusively in the Nordic region. Therefore, this paper is not only to provide a closer look on this topic for four Nordic countries, but also can be treated as a reference for

comparative analysis of the impacts of determinants on capital structure between the region and the United States, or common developed European countries.

1.1 Purpose and Scope of this Paper

The purpose of this study is to investigate how different factors, at both firm-level and country-level, have their impacts on the choice of capital structure for publicly listed firms in four Nordic countries including Denmark, Finland, Norway and Sweden over the period from 2004 to 2017. The study aims to answer the following research questions:

- How do firm-specific determinants affect the capital structure choice of public listed firms in the Nordic region?
- Is there any industrial effect on the firm-specific determinants in the Nordic region? Or in another words, is there any difference in the effect of firm-specific determinants across industries in the Nordic region?
- Is there any effect of financial crisis in 2008 on the firm-specific determinants of capital structure?
- How do country-specific determinants affect the capital structure choice of firms in the Nordic region?

This paper examines public listed firms in four Nordic countries including Denmark, Finland, Norway and Sweden over the period of 14 years 2004 – 2017. Data sample is, on the one hand, further divided into different industrial sectors to examine the industrial effect, and on the other hand divided into pre-crisis and post-crisis period to examine the crisis effect on determinants of capital structure.

1.2 Contribution of this Paper

Although there have been a lot of studies on determinants of capital structure, most of them focus on American and common European countries, while only few studies have been made to examine the choice of capital structure in the Nordic region. Therefore, this paper contributes to examines the effect of both firm-specific and country-specific determinants on the debt ratio for public listed firms in four Nordic countries. In addition to macroeconomic effects, this paper also examines the effect of industrial classification and financial crisis in 2008 on the choice of capital structure for public firms in the Nordic region.

1.3 Limitation of this Paper

Due to the choice of selected countries in the data set, as well as the choice of selected industrial sectors, this paper possesses following limitation.

The first limitation is that the proximity in geographical location as well as the similarity in macroeconomic factors lead to the exclusion of commonly adopted independent variables such as corruption and legal system dummy variable. These exclusions may lead to a significant difference in the relationship of independent variables in comparison to prior existing literature.

The second limitation is that this study from the beginning has excluded financial firms from the final sample set as I find that these financial firms have a distinct capital structure behavior due to their liquidity characteristic. This exclusion may yield a different estimation result in comparison to the sample set which fully includes financial firms. However, for these financial firms, separate analysis should be conducted and afterward compared to firms operating in other sector to gain a more thorough understanding of the determinants of capital structure.

1.4 Structure of this Paper

This paper is divided into six main sections. After this introduction section, the second section aims to introduce some important theoretical background relating to capital structure and relevant existing empirical studies on determinants of capital structure. The third section aims to provide an overview of the methodology to be used in this study. The fourth section provides a detail introduction to the data and sample set, as well as all the firm-specific and country-specific determinants of capital structure and hypotheses. The fifth section provides estimation results and the last section provides the conclusion of the study.

2 Literature review

2.1 Theoretical Background

The first part of this section provides an overview on all of the notable theories related to the capital structure, which include Modigliani and Miller (1958), the pecking order theory (Myers and Majluf, 1984), the static trade-off theory, and the agency cost (Jensen and Meckling, 1976).

2.1.1 Modigliani and Miller Propositions

In most of the existing empirical studies on the topic of the capital structure, Modigliani and Miller (1958) is frequently referred as the pioneer on this research area. Theoretically, their theory was developed based on a set of assumptions, including perfect market condition with symmetries of information, no taxes, no transaction costs, no risk of default and no bankruptcy costs. The theory suggests that the choice of capital structure has no impact on the market value of firms, as firms and outside investors could equally access to the financial market due to the symmetries of information and no restriction on taxes as well as transaction costs. However, because of these assumptions, the theory is considered to be irrelevant in the real-world context, as most of the assumptions are not applicable in practice.

2.1.2 The Static Trade-off Theory

With Modigliani and Miller propositions as a foundation, the static trade-off theory further explains the choice of companies on their capital structure. The theory implies that firms are always making trade-off decision to balance between the benefits of debt financing and the costs of financial distress and bankruptcy risk due to the high level of leverage, and therefore, the optimal capital structure could be achieved when these firms balance between the benefits and the costs of debts.

The theory takes into consideration the tax deductible on debt's payment as a reliable method to lower firms' weighted average cost of capital by obtaining more debt over equity. However, as the portion of debt becomes higher, firms also face a higher probability of failure to pay for their debt's obligation and other types of financial distress. Furthermore, from the lender's perspective, they are more likely to require a higher cost of debt to compensate for the increase in lending risk as the debt ratio of the borrowing company getting higher. As a result, the benefits of debt will be offset by the increase in cost of debts.

However, the static trade-off theory is not fully supported by empirical evidences from prior studies. Myers (1993) found the inverse correlation between profitability and firm's leverage in the US market, while Titman and Wessels (1988) also found a significant negative relationship between profitability and leverage ratio for public firms. One of the reasons for the irrelevance of the static trade-off theory is that in reality, tax shield benefit derived from deductible interest payments is large and certain, meanwhile the costs of financial distress are uncertain and less important for public firms.

2.1.3 The Pecking Order Theory

The pecking order theory by Myers and Majluf (1984) provides a preference order when it comes to financing decision for companies, whether it is internal financing or external financing through debt and equity issues. The theory takes into account the presence of information asymmetry to explain the pecking order: in general public firms are more likely to prefer internal financing to external financing, and in case of external financing, firms may seek to the safest security first, which includes convertible bonds, different types of debts. According to the theory, equity issues are considered as a last resort when it comes to financing decision made by public firms.

Theoretically, because of the presence of information asymmetry, public firms' managers are more likely to have more information and knowledge about their firms, including firms' operation activities and upcoming investment projects, than outside investors. Because outside investors most often do not have the comprehensive information about the company, they analyze and assess the company's potential based on a set of signals and based on the company's decision, which also includes equity issue decision. These outside investors consider equity issue decision as a bad signal, based on their assumption that managers and existing shareholders are never willing to dilute the benefits of their existing shares to outside investors, unless there is no potential positive NPV projects. As a result, equity issue decision is less favorable to outside investors, which in turn has negative impact on the share price (Myers and Majluf, 1984).

On the other hand, public firms could also utilize the information asymmetries to send out positive signals to outside investors in a form of bond issues or bank loans decision. Because banks are considered to be sophisticated lenders and most often require a strict requirement for lending procedure, for outside investors, bank loans announcement from public firms is considered as a good signal for the firms' prospect. In practice, "good" firms are more willing to borrow with short maturity because their probability of needing

additional funding in the short-term is rather low. Thus, these “good” firms may send out positive signal to outside investors by borrowing with short maturities, which affects their choice of leverage level.

From the perspective of firms’ managers, they are more discouraged to issue equity to finance upcoming potential positive NPV projects, because they are afraid equity issued will be undervalued due to the information asymmetry between managers and outside investors. Therefore, the theory suggests that firms are more likely to finance their investment opportunities with safest security first, which starts from retention and other types of internal financing, then debt as the first source of external financing, followed by hybrid securities such as convertible bonds and finally equity as the last resort of external financing. The theory also helps to explain why managers, for the benefits of existing shareholders, are willing to reject potential positive NPV projects if those projects require equity financing.

2.1.4 The Agency Cost

Jensen and Meckling (1976) defined agency cost as the type of costs occur when corporate managers and shareholders attempt to act in their own self-interests and thus there is the existence of differences in interest between these two parties. More specifically, the theory suggests that there are two types of agency conflicts: one is the conflict between the managers and the stakeholders, and another one is the conflict between shareholders and debtholders of public firms.

One of the reasons for the conflict between the managers and the stakeholders is that while shareholders’ optimal objective is to maximize their return-on-investment and firm’s value, corporate managers may make their decisions not to maximize shareholders’ benefits but to maximize their own private benefits. Consequently, such conflict could yield the issue of asset substitution or the issue of underinvestment. In the case of asset substitution, managers pay more attention to the payoff in the good scenario and pay less attention to the magnitude of loss in case of bankruptcy. It leads to the case where these corporate managers have an increased incentive to undertake risky projects as debt level increases even when those risky projects have negative NPV.

On the other hand, one of the reasons for the conflict between shareholders and debtholders is because of the underinvestment problem. Underinvestment occurs because shareholders’ interest is to maximize their return-on-investment, while debtholders’ interest is to redeem the fixed amount of debt repayment. Therefore, shareholders are not only more willing to accept risky projects in order to maximize their benefits even when these projects

have negative NPV, but they are also more willing to forego valuable investment opportunities if these opportunities transfer the wealth from the shareholders to the debtholders and leave insufficient returns to the shareholders.

2.2 Previous Literature Review

Existing literature for a long time has studied the impacts of different determinants on the capital structure of public firms in several countries and regions. Although most of the studies used Modigliani and Miller theorem, static trade-off theory, pecking order theory and agency cost as their theoretical foundation, these studies, however, often yielded a mixed result about the impacts of determinants on the capital structure. One of the reasons for the inconsistent results may be because different authors adopted different measurement and regression method in their research. Another explanation may be because for different countries, the impact of determinants on capital structure is different due to the existence of country effect and industrial effect. The impact of these two factors will be further discussed in the following chapters in this paper.

Rajan and Zingales (1995) in their *“What do we know about capital structure? Some evidence from international data”* published on The Journal of Finance studied the effect of firm-specific determinants on the capital structure of public listed firms in the major industrialized countries in G7 countries. The study found that there is little difference in the leverage ratio between public firms in G7 countries. Moreover, the authors found a significant relationship between a set of firm-specific factors and the debt ratio for public listed firms. These firm-specific factors include tangibility, profitability and firm size.

Bancel et al. (2004) in their *“Cross-country determinants of capital structure choice: a survey of European Firms”* published on Financial Management studied the determinants of capital structure in 16 European countries. The authors found that although legal framework is usually considered as an important factor of debt policy, there is no correlation between legal environment and the common stock policy. Furthermore, the paper found that public firms determine their capital structure by trading off costs and benefits of financing, which is consistent with the static trade-off theory discussed in the earlier section.

Deesomsak et al. (2004) in their *“The determinants of capital structure: evidence from the Asia Pacific region”* published on Journal of Multinational Financial Management studied the effect of both firm-specific and country-specific determinants on the capital structure for public listed firms across four countries: Thailand, Malaysia, Singapore and Australia. Using both fixed effect and ordinary least square regression model, the authors

found a positive relationship between firm size and leverage ratio for public firms across four countries. On the other hand, growth opportunities, non-debt tax shields as well as liquidity have negative association with the debt ratio. More importantly, the paper demonstrated the existence of country effect on the determinants of capital structure, as different determinants are found to have different impacts on leverage for each country.

Huang (2006) in his “*The determinants of capital structure: Evidence from China*” published on China Economic Review studied the impact of firm-specific determinants on capital structure of more than 1,200 public listed firms in China. The author found a significant positive relationship between firm size and leverage ratio, and a significant negative correlation between profitability, non-debt tax shields, and growth opportunities with the leverage for Chinese public listed firms.

De Jong et al. (2008) in their “*Capital structure around the world: The roles of firm- and country-specific determinants*” published on Journal of Banking and Finance studied the effect of both firm-specific and country-specific determinants on the capital structure of public firms in more than 40 countries across the globe. The paper demonstrated a significant correlation between a set of firm-specific determinants, which include tangibility, firm size, growth opportunities and profitability, and leverage ratio. For the macroeconomic factors, the authors found that the development of the bond market and the GDP growth rate also have significant impacts on the capital structure. They also found evidence of the existence of the country effect on determinants of capital structure, as different determinants showed different impacts on leverage ratio for public firms operating in different geographical locations.

3 Methodology

3.1 Introduction

Like previous literature and academic papers examining determinants of capital structure across firms, the data set in this thesis is categorized as panel data, which includes both cross-sectional and time-series observations. As the nature of panel data set, the three most common approaches used in previous literature are Ordinary Least Squares (OLS), fixed effect and random effect method. OLS is least preferred in previous literature because of the likelihood of endogeneity or heteroscedasticity; as a result, fixed effect and random effect are more often adopted by previous literature. This chapter provides a comparative analysis of these empirical methods.

3.2 Pooled OLS Regression versus Fixed Effects Model

The simple standard OLS regression model for a panel data with cross-sectional individual ($i = 1, 2, \dots, n$) and time period t ($t = 1, 2, \dots, n$) can be written as follows:

$$y_{it} = \alpha + \beta x_{it} + u_{it} \quad (1)$$

in which x_{it} is the k -dimensional vector of the independent variables and β is the slope coefficients for the independent variables. The error term u_{it} captured all the unobserved factors that have an effect on y_{it} (Brooks, 2008). Residuals value for the error term \hat{u}_{it} is measured as follows:

$$\hat{u}_{it} = y_{it} - \hat{y}_{it} \quad (2)$$

The pooled OLS regression is based on a following set of assumptions:

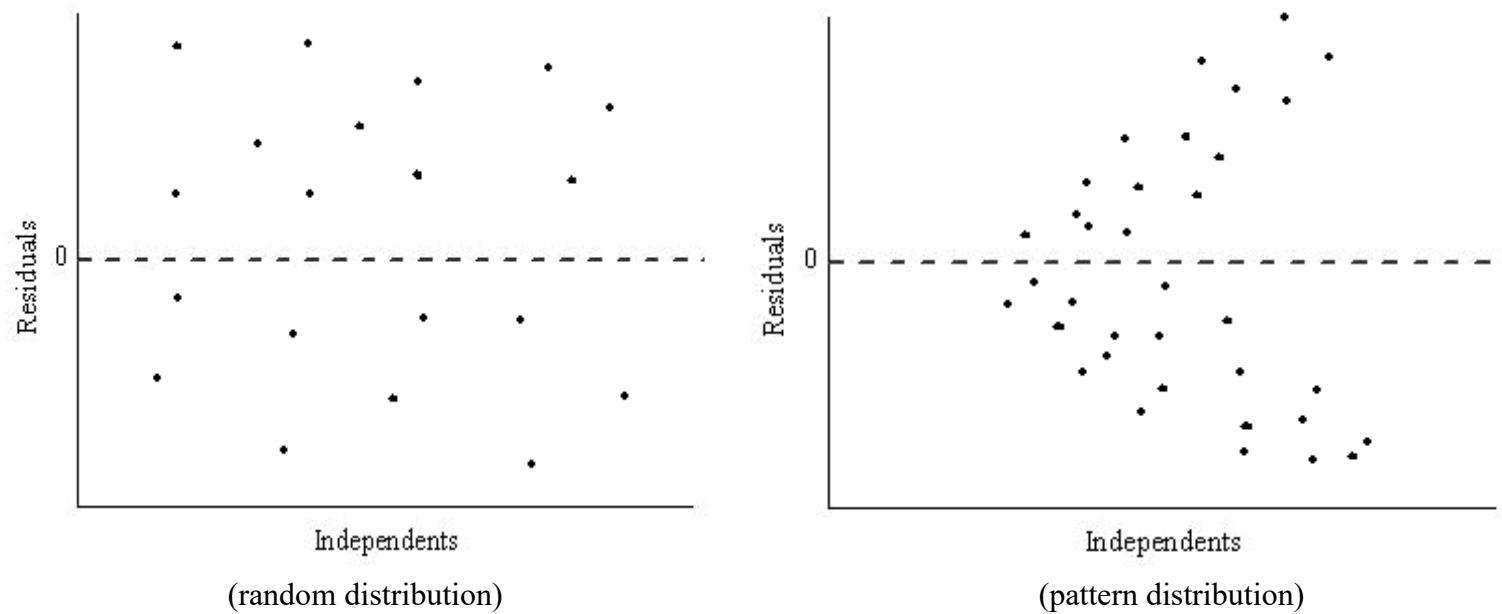
- The expected mean value for the error terms given X should be equal to 0, or

$$E(u_{it} | x_{it} = X) = 0$$

which indicates independent variables should capture all effects and only the unpredictable randomness left over to the error terms. Therefore, the expected mean value for the error terms should be equal to 0 and there is no clear pattern for the residuals. Figure 1 below illustrates the scatter plots for residuals in two scenarios: random scatter plots which indicates there is no correlation between error terms and independent variables, and “pattern” scatter plots which indicates there are still some uncaptured effects left in the error terms that the independent variables are not able to predict.

Figure 1: Residuals Scatter Plots Illustration: random vs. pattern

Figure 1 provides the illustration of the distribution of residuals presented as scatter plots. The left scatter plot indicates the randomness in the distribution, and the mean value for residuals should equal to 0. The right scatter plot shows a clear pattern, which indicates there are still some uncaptured effects left over that the independent variables failed to predict.



- Another assumption is that all observations are independent and identically distributed over the times series, which means a set of (x_{it}, y_{it}) should have the same distribution as (x_{jt}, y_{jt}) and (x_{it}, y_{it}) is independent from (x_{jt}, y_{jt}) for all i different from j . One important implication for the independent and identically distributed property is the homoscedasticity, which implies the error terms across all values of independent variables are constant. If the error terms are not constant across independent variables, then there is the existence of heteroscedasticity in the data model. An example for the heteroscedasticity is the case of the relationship between age and salary level: the variance in wages for people in the age between 20s-30s is pretty small, because most of them are students or fresh graduates entering early stage of their career. However, as these people get older, they are more likely to differentiate in career development to each other, and thus the gap between wage levels become much more noticeable. Some people working in large corporates have much higher salary level than people working part-time at McDonald, for an example. Therefore, in this case, there is the variation in the difference between wage level for different ages, which represents the heteroscedasticity in the regression model.

Because of the strict assumptions mentioned above, most often using Pooled OLS regression for time-series analysis is not preferred if the assumptions are not met. More specifically, when there is the existence of auto-correlation, multicollinearity or heteroscedasticity, Pooled OLS regression will result in inconsistent and biased estimators. Most of the time, the problem with the Pooled OLS model stays within the error terms with very strict assumptions. In order to tackle this problem, fixed effects models further split the error terms u_{it} into two different components, which consist of an individual specific effect μ_i and the remain unexplained disturbance v_{it} . In this case, the equation (1) of OLS regression could be rewritten for the fixed effects model as below:

$$y_{it} = \alpha + \beta x_{it} + \mu_i + v_{it} \quad (3)$$

in which μ_i ($i = 1, 2, \dots, n$) are fixed unknown constant that captures all the time-invariant variables that have effects on y_{it} , unlike the Pooled OLS model. And due to the fact that this equation (3) have both constant α and μ_i , the intercept term α is then removed from the equation without affecting the equation because individual intercept μ_i has captured already the effect of the intercept term α . Because of the separation between time-invariant effect and remain unexplained effects in the error terms, fixed effects models are less likely to

result in biased or inconsistent estimators than Pooled OLS regression model, even when there is the existence of heteroscedasticity, or there is a correlation between error terms and independent variables.

In summary, due to the fact that the data set used in this paper is panel data with cross-sectional independent variables over a time series from 2004 to 2017, using Pooled OLS regression is most likely to result in biased and inconsistent estimators because of the drawbacks in the strict assumptions of the model discussed above. Therefore, in this paper, fixed effects model will be used to find the estimators for firm-specific determinants on the capital structure of public firms in the Nordic region. In the next section, I will discuss the fixed effects model used for the data set in this paper in more details.

3.3 The Fixed Effects Model

For firm-specific determinants, details on fixed effect regression model is described below:

$$LEV_{i,t} = \alpha + \beta_1 TAN_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 RISK_{i,t} + \beta_4 NDS_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 PROFIT_{i,t} + \beta_7 LIQ_{i,t} + \varepsilon$$

in which $LEV_{i,t}$ is the leverage ratio, calculated by dividing the book value of long-term debt to the book value of total assets. For the explanatory firm-specific variables in the regression model, it includes tangibility (TAN), firm size (SIZE), business risk (RISK), non-debt tax shields (NDS), growth opportunities (GROWTH), profitability (PROFIT) and liquidity (LIQ). More details on each firm-specific determinants are presented in the next chapter.

After testing the multicollinearity between independent variables by using pairwise correlation matrix, it is also necessary to test the existence of heteroscedasticity in the panel data set. In this paper, I use Breush-Pagan test (or White test) to detect the heteroscedasticity. More specifically, if the t-statistic result of the Breush-Pagan test is significantly different from zero at 5% or 1% confidence level, then there is the existence of the heteroscedasticity in the sample data set. In that case, the Pooled OLS is no longer a reliable regression method to be used for my panel data set.

After the Breush-Pagan test, to further support the selection between fixed effects and random effects model, I will use Durbin-Wu-Hausman test (or Hausman specification test) to examine the difference between values of coefficients across two methods. In this paper, as the result for the Hausman specification test is significantly large, the fixed effects model is preferred to the random effects model.

For country-specific determinants, the equation is the extent model of the firm-specific determinant model by adding additional macroeconomic indicators to the equation as below:

$$\begin{aligned} LEV_{i,t} = & \alpha + \beta_1 TAN_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 RISK_{i,t} + \beta_4 NDS_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 PROFIT_{i,t} \\ & + \beta_7 LIQ_{i,t} + \beta_8 BANK_{i,t} + \beta_9 STOCK_{i,t} + \beta_{10} GDPGROWTH_{i,t} + \beta_{11} INFLATION_{i,t} \\ & + \beta_{12} BOND_{i,t} \varepsilon \end{aligned}$$

in which macroeconomic indicators consist of development of the banking industry (BANK), development of the stock market (STOCK), development of the bond market (BOND), GDP growth rate (GDPGROWTH) and inflation rate (INFLATION). More details on each country-specific determinants are also presented in the next chapter. However, unlike the firm-specific determinants, I use the Pooled OLS model to study the impact of country-specific determinants on the capital structure. The reason is that fixed effect model cannot tolerate the constant variance between different firms in the same country for macroeconomic indicators.

4 Data and Samples

This section is to describe the sample set used to analyze in this thesis, as well as to provide a more detailed data selection procedure and an overview on some key statistics of the sample set, including descriptive statistics and correlation matrix on firm-specific determinants.

4.1 Sample Selection

Firm-specific and country-specific determinants are the two major types of variables that I take into account in analyzing their impacts on firms' leverage ratio. Using solely firm-specific determinants to analyze their impacts on leverage ratio could provide meaningful results. However, these results are not comprehensive due to the fact that the use of debt in public firms may vary across different countries because of difference in economic environment, legal framework, inflation and other economic indicators. Therefore, when analyzing the impacts of determinants on capital structure across several countries, it is necessary to include country-specific economic indicators into the analysis.

In my regression model, long-term debt to book value of total assets ratio is my main dependent variable. Some previous literature use total debt ratio as an alternative option for their dependent variable; however, I find that the total debt ratio might not truly reflect the leverage level of the company in the long term as it also includes the proportion of short-term debt which is due within one year. Although short-term debt is an important factor when evaluating firms' current performance, its nature makes it become a poor indicator for the performance in a longer time horizon. Therefore, in this paper, long-term debt ratio is selected as my main dependent variable, and total debt ratio is used mainly for comparison and robustness check purpose.

For firm-specific determinants, the primary source is Thomson Reuters Eikon Database, which contains financials on companies from a wide range of industries. I restrict my sample set to those firms listed on the stock market of the country in which it is domiciled. The initial sample set covers five Nordic countries, including Sweden, Norway, Finland, Denmark and Iceland. However, after the extracting-and-transforming process, there were only 15 firms available for the Iceland market for the covered period from 2004 to 2017, while for other countries the minimum firm number was 66 (Denmark). Due to the fact that including these 15 public firms from Iceland is likely to make the pooled data set

imbalanced because of its small number of observations, my final data set, as a result, excludes Iceland and includes Denmark, Finland, Norway and Sweden.

For macroeconomic indicators, the primary source includes World Development Indicators and Financial Structure Database of the World Bank. My initial sample period covers the years 2004 – 2018, initially. However, most of the required country-specific data are only available until 2017, thus my final sample set covers the period of 2004 – 2017.

For my initial sample set, 756 listed firms were identified in the Nasdaq Stockholm, 203 listed firms were identified in the Oslo Stock Exchange, 139 listed firms were identified in the Nasdaq Helsinki and 115 listed firms were identified in the Nasdaq Copenhagen. My selection and screening procedure is based on two sets of rules: the first rule is that all financial companies including banks, financial firms, investment or insurance firms will be excluded from the final sample set. The main reason is that these financial companies are more likely to have a much higher liquidity that affects their unique capital structure. The second rule is that all companies with overwhelming missing observations are excluded from the final sample set. While most often it is impossible to have all available firm-year observations for four countries, I resort to some other alternative sources to collect the missing data if possible, including collecting missing data from firms' financial statements manually. As a general rule, I exclude all public firms with missing values for more than 6 years in the total covered period of 14 years (from 2004 to 2017) from the initial sample set.

In the end, my final sample set for each country includes 272 Swedish listed firms, 131 Norwegian listed firms, 95 Finnish listed firms and 67 Danish listed firms. The pooled sample consists of a strongly balanced panel of 565 listed firms over a period of 14 years from 2004 to 2017 in Nordic markets, totaling 7,910 firm-year observations. Table 1 provides a description of the final sample set.

Table 1: The Final Sample Set

Table 1 provides a description of the final sample set: the number of years that data are available for each country, the number of firms per year for each country, the total firm-year observations and the proportion of selected firms in the final sample by the total number of listed firms in each country

Country	Number of Years of Data Used	Number of Firms in the Final Sample	Firm-years Observations	Number of Firms in the Final Sample/Total Number of Listed Firms
<i>Denmark</i>	14	67	938	58%
<i>Finland</i>	14	95	1,330	68%
<i>Norway</i>	14	131	1,834	64%
<i>Sweden</i>	14	272	3,808	36%
Total		565	7,910	

4.2 Dependent Variable

The three most common measurement for leverage ratio are long-term debt ratio, short-term debt ratio and total debt ratio (Booth et al., 2001; Deesomsak et al., 2004; Huang, 2006). In this paper, long-term debt ratio is my main dependent variable, and total debt ratio is only used for comparison and robustness test purpose. The reason for adopting long-term debt ratio instead of the other two is because the main objective of this paper is to find the relationship between a set of determinants on both firm-specific and country-specific level and the level of debt for public firms in the long run. Meanwhile, short-term debt is mostly used for short-term analysis and therefore, total debt ratio might not truly reflect the leverage level of these public firms in the long-term.

In this paper, the long-term debt ratio is measured as the ratio of the book value of long-term debt to the reported book value of total assets and calculated as follows:

$$\text{Long-term debt ratio (LEV)} = \frac{\text{Long-term Debt}}{\text{Total Assets}}$$

Table 2 and Table 3 below show the average of long-term debt ratio and average of total debt ratio for listed firms in the Nordic region. As it can be seen from the two tables, across four Nordic countries, except for Sweden, total debt ratio adopted by public firms ranges from 25% to 30%: on average, public firms in Norway adopt the highest level of total debt (31%), while firms in Sweden adopt a much lower level of total debt (16%). On the other hand, from these two tables, we can estimate that most of public firms in Nordic region adopt short-term debt at around 6%-8% on average. In terms of long-term debt ratio, public firms in Denmark and Finland are very similar in adopted level of long-term debt (16%-17%), while public firms in Norway have around 22% of long-term debt on average for the period from 2004 to 2017.

Table 2: The Average Long-term Debt Ratio across Nordic countries

Table 2 provides the average value of long-term debt ratio (LEV) across four Nordic countries including Denmark, Finland, Norway and Sweden in the period 2004 – 2017.

Long-term Debt Ratio 2004 – 2017	Denmark	Finland	Norway	Sweden
2004	16.35 %	15.20 %	19.45 %	10.70 %
2005	17.87 %	14.06 %	19.40 %	10.49 %
2006	17.84 %	14.57 %	19.37 %	10.15 %
2007	14.40 %	15.72 %	22.78 %	11.09 %
2008	17.87 %	18.70 %	23.50 %	12.56 %
2009	20.79 %	18.67 %	22.64 %	11.70 %
2010	20.41 %	16.52 %	22.49 %	10.40 %
2011	19.24 %	18.02 %	23.34 %	11.02 %
2012	16.98 %	15.92 %	21.97 %	10.65 %
2013	17.87 %	17.05 %	23.18 %	10.02 %
2014	14.38 %	15.74 %	20.77 %	10.06 %
2015	15.93 %	16.75 %	21.56 %	10.44 %
2016	16.26 %	18.16 %	22.16 %	10.60 %
2017	16.46 %	15.13 %	21.69 %	10.81 %
Average	17.33 %	16.44 %	21.74 %	10.76 %

Table 3: The Average Total Debt Ratio across Nordic countries

Table 3 provides the average value of total debt ratio across four Nordic countries including Denmark, Finland, Norway and Sweden in the period 2004 – 2017.

Total Debt Ratio 2004 – 2017	Denmark	Finland	Norway	Sweden
2004	26.25 %	21.99 %	28.98 %	15.69 %
2005	27.02 %	20.56 %	25.40 %	16.40 %
2006	30.00 %	21.14 %	27.27 %	14.94 %
2007	26.01 %	24.41 %	28.92 %	16.35 %
2008	29.66 %	28.58 %	33.91 %	18.76 %
2009	30.79 %	27.26 %	32.12 %	16.93 %
2010	29.83 %	24.08 %	34.82 %	15.96 %
2011	26.99 %	26.65 %	34.43 %	16.67 %
2012	27.74 %	24.47 %	33.53 %	16.87 %
2013	25.66 %	25.88 %	29.96 %	16.22 %
2014	22.87 %	24.57 %	29.29 %	15.49 %
2015	23.55 %	24.64 %	31.71 %	16.14 %
2016	22.53 %	24.64 %	31.28 %	16.35 %
2017	22.36 %	21.86 %	30.60 %	16.60 %
Average	26.52 %	24.33 %	30.87 %	16.38 %

4.3 Independent Variables

In this paper, the independent variables and their measurement are selected because they have been widely adopted by prior empirical literatures in the past years. Additionally, I believe this consistency in variable selection is helpful in comparing the results with existing empirical studies, especially when comparing with other developed economies in Europe and in the U.S. Generally, independent variables consist of two sets of variables: firm-specific determinants and country-specific determinants; details on each variable are presented below.

4.3.1 Firm-specific independent variables

Although the topic on how we could select a set of firm-level factors that have impacts on the capital structure are quite controversial in previous literature, most of the selection were based on traditional capital structure theories, including static trade-off theory, pecking order theory, agency cost and asymmetric information. Among different models adopted in prior empirical studies, the most commonly used variables as firm-specific determinants of capital structure are tangibility, firm size, non-debt tax shields, growth opportunity, business risk, profitability and liquidity.

4.3.1.1 Tangibility (*TANG*)

Tangibility measured the percentage of tangible assets in total assets, and is defined as the ratio of fixed assets to the book value of total assets. In this paper, tangibility (*TANG*) is calculated as below.

$$Tangibility\ (TANG) = \frac{Fixed\ Assets}{Total\ Assets}$$

On the relationship between tangibility and the capital structure, trade-off theory suggests that a firm with higher level of tangibility can use these additional assets as collateral when seeking for external finance. For these firms, they are more likely to have a lower cost of debt compared to other public firms whose proportion of tangible assets is low. This could be explained from the perspective of the lenders that a higher portion of collateral would diminish their lending risk; as a result, these lenders are more likely to require a lower cost of debt from the borrowers. Furthermore, the liquidation value of a public firm increases with the tangibility of its assets and, at the same time, decreases the probability of mispricing in the event of bankruptcy (Deesomsak et al., 2004). Therefore, a high ratio of tangible assets is expected to be associated with a high level of adopted leverage for public firms. Prior literature also found a statistically significant positive relationship between tangibility and leverage (Rajan and Zingales, 1995; De Jong et al., 2008; Fan et al., 2012).

On the other hand, this relationship between tangibility and leverage could also be explained by the fact that public firms with higher proportion of tangible assets in general are more likely to be in a mature industry and therefore these firms can afford higher level of debt to take advantage of their lower risk level. However, this really depends on which industry these firms are operating: for an example, public firms operating in IT industry usually have a large portion of intangible assets; as a result, their capital choice may differ from what the pecking-order theory suggested, especially when their lenders are more likely to require excessive premiums for the higher risk of lending. And because of the higher cost

of debt, these firms may prefer equity issue to debt when they need financing. To discuss even further about the industry effects on tangibility and leverage, all public firms in my dataset are also categorized under different sectors following the Global Industry Classification Standard (GICS). Table 4 and Table 5 below show the average of tangibility and the average of leverage ratio for Nordic public firms.

Table 4: The Average Tangibility across GICS sectors for Nordic public firms

Table 4 provides the average tangibility of the period 2004 – 2017 across GICS sectors.

GICS Sector Name	Denmark	Finland	Norway	Sweden
<i>Communication Services</i>	52.39 %	48.81 %	45.99 %	43.15 %
<i>Consumer Discretionary</i>	53.79 %	33.93 %	38.32 %	23.80 %
<i>Consumer Staples</i>	57.96 %	47.78 %	46.51 %	40.42 %
<i>Energy</i>	75.30 %	59.70 %	65.20 %	62.05 %
<i>Health Care</i>	26.85 %	32.49 %	30.34 %	38.79 %
<i>Industrials</i>	42.45 %	30.84 %	49.06 %	30.77 %
<i>Information Technology</i>	32.06 %	22.85 %	23.04 %	21.45 %
<i>Materials</i>	57.77 %	48.57 %	48.88 %	61.23 %
<i>Real Estates</i>	71.44 %	73.02 %	72.38 %	66.11 %
<i>Utilities</i>	62.62 %	75.37 %	69.27 %	49.97 %

Table 5: The Average Total Debt Ratio across GICS sectors for Nordic public firms

Table 5 provides the average total debt ratio of the period 2004 – 2017 across GICS sectors.

GICS Sector Name	Denmark	Finland	Norway	Sweden
<i>Communication Services</i>	20.17 %	29.13 %	20.21 %	16.52 %
<i>Consumer Discretionary</i>	37.03 %	25.67 %	28.35 %	16.47 %
<i>Consumer Staples</i>	22.08 %	23.68 %	33.32 %	18.13 %
<i>Energy</i>	38.22 %	24.12 %	38.76 %	17.18 %
<i>Health Care</i>	19.73 %	19.33 %	13.05 %	10.45 %
<i>Industrials</i>	27.47 %	24.88 %	32.51 %	19.60 %
<i>Information Technology</i>	12.47 %	21.20 %	19.33 %	10.02 %
<i>Materials</i>	32.50 %	28.70 %	21.30 %	16.50 %
<i>Real Estates</i>	63.10 %	14.84 %	39.04 %	41.39 %
<i>Utilities</i>	27.23 %	30.70 %	47.83 %	21.77 %

As it can be seen from the two tables, for public firms operating in real estates, energy and utilities sector, they have a very high portion of tangible assets; meanwhile, firms operating in health care and IT sector have a relatively lower level of tangible assets. These figures are reasonable because real estates, energy and utilities sectors, unlike the service industry, are very capital intensive and much often require a larger amount of initial investments on infrastructure and PPE (property, plant and equipment) for their projects. For the total debt ratio for these firms, they also have a much higher leverage (63.10%, real estate sector, Denmark) compared to health care (19.73%, Denmark) and especially IT sector (12.47%, Denmark). These figures are consistent with the trade-off theory and the earlier discussions in this section.

4.3.1.2 Firm Size (SIZE)

In this paper, firm size measures the scale of public firms by using the natural logarithm of the book value of their total assets and is calculated as below.

$$\text{Firm Size (SIZE)} = \ln(\text{Total Assets})$$

On the relationship between the size of public firms and their leverage ratio, theories suggested that these two variables have a positive relationship, although their explanation may differ. From the point of view of static trade-off theory, public firms always have to balance or make trade-off decision: on the one hand are the benefits of leverage, including tax savings and higher return on investment, and on the other hand are the costs of high leverage, including risk of bankruptcy, higher cost of debt, and financial distress. However, for large public firms, their operations are more diversified than the others, their business stage is more mature, and their reputation is already secured in the industry. As a result, not only big firms are willing to trade-off “more” for the benefits to the costs of high leverage, but also lenders are more likely to offer them some kinds of “discount” on borrowings because of the safe and secured reputation. On the other hand, smaller firms, due to their higher risk of lending, either have a higher cost of debt for their debt financing, or may prefer equity financing as an alternative for their need of external financing. Prior studies also found a positive relationship between firm size and leverage ratio (Titman et al., 1988; Rajan and Zingales, 1995; Wald, 1999). Figure 2 and Figure 3 below show the average long-term debt ratio for five biggest public firms and five smallest public firms in terms of their total assets.

Figure 2: The Average Long-term Debt Ratio of Five Biggest Nordic Public Firms

Figure 2 provides the average long-term debt ratio of the period 2004 – 2017 of five biggest public firms in terms of their total assets.

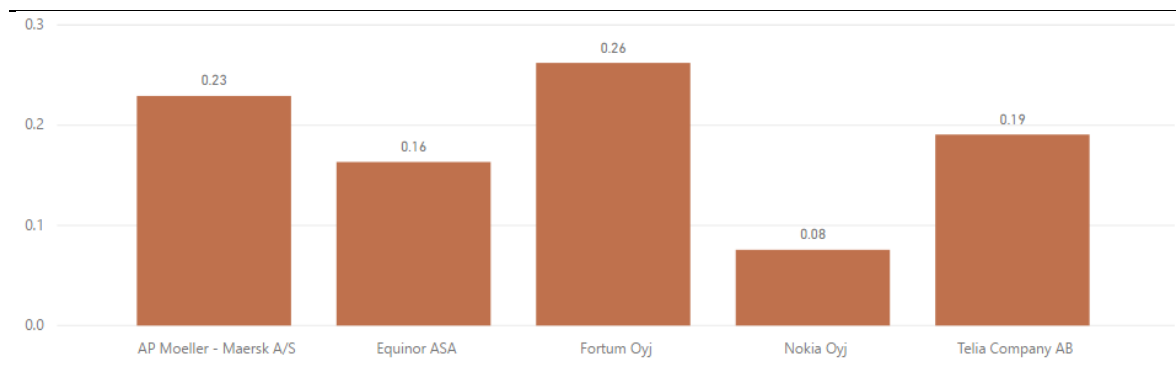
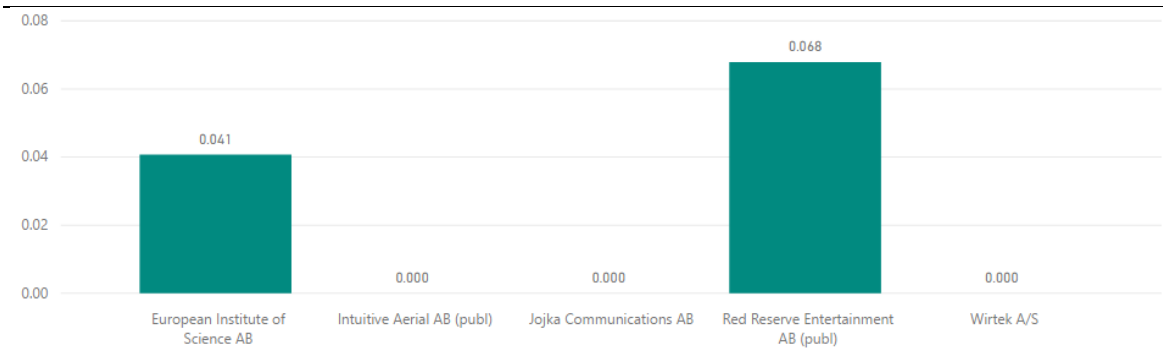


Figure 3: The Average Long-term Debt Ratio of Five Smallest Nordic Public Firms

Figure 3 provides the average long-term debt ratio of the period 2004 – 2017 of five smallest public firms in terms of their total assets.



As it can be seen from the two figures, in terms of total assets, five biggest public firms in Nordic consist of AP Moeller – Maersk A/S (a Danish business conglomerate operating mainly in the transport, energy and logistics sector), Equinor ASA (a Norwegian multinational petroleum and wind energy company), Fortum Oyj (a Finnish leading clean-energy company), Nokia Oyj (a Finnish multinational communications and IT company) and Telia Company AB (a Swedish dominant telephone company and mobile network operator). These firms have been adopting an average of around 16% - 26% for long-term debt during the period from 2004 to 2017, with Nokia Oyj is the only exception with average ratio around 8%. On the other hand, five smallest public firms in terms of total assets either have been operating on a very low portion of long-term debt, around 4% - 7% on average, or no long-term debt at all. These figures are consistent with the static trade-off theory discussed above.

4.3.1.3 Business Risk (RISK)

In this paper, business risk measured the volatility of public firms' earnings as an indicator for probability of bankruptcy and financial distress. Business risk is calculated as the absolute difference between annual percentage change in operating income, or earnings before interest and tax (EBIT), and the mean value of these changes.

$$\text{Business Risk (RISK)} = |\% \text{Growth(EBIT)} - \text{mean}(\% \text{Growth(EBIT)})|$$

However, prior literature used different measurements to calculate the business risk: the method mentioned above follows the method used by Deesomsak et al. (2004); on the other hand, Booth et al. (2001) measured the business risk using variability of the returns on assets over the sample period. While the increased variability in the returns on assets implies an increase in the short-term operational component of the business risk, one of the drawback

of this measurement is that it cannot capture the component of the risk in the longer-term, such as competitive entry (Booth et al., 2001). Theoretically, trade-off theory and bankruptcy costs suggested that public firms with volatile earnings have higher probability of bankruptcy and financial distress, as these firms may not be able to fulfil their debt commitments. Therefore, a high volatility in earnings reduces firms' capacity for debt financing and the business risk is expected to be negatively correlated with leverage.

In practice, prior literature showed mixed results for the relationship between leverage ratio and the business risk: earnings volatility appears to have no significant effect on leverage in all four Asian countries in the sample, including Thailand, Malaysia, Singapore and Australia (Deesomsak et al., 2004); on the other hand, leverage ratio is positively correlated with the business risk in Jordan, and vice versa in Korea (Booth et al., 2001). One of the explanation for the mixed results is that in some cases, public firms may not take into account the volatility of their earnings for their debt financing decision if the risks and costs of entering into liquidation for these firms are not significant, which may be the case in Australia when public firms have their borrowing level well below their debt servicing capacity (Deesomsak et al., 2004).

4.3.1.4 Non-debt Tax Shields (NDTS)

In this paper, non-debt tax shields is measured as the ratio of depreciation and amortization to the book value of total assets, due to the fact that depreciation and amortization are the most significant elements in the non-debt tax shield and is calculated as below.

$$\text{Nondebt Tax Shields (NDTS)} = \frac{\text{Depreciation} + \text{Amortization}}{\text{Total Assets}}$$

From the point of view of the static trade-off theory, one of the main reasons why some public firms prefer debt financing to equity financing is because they want to utilize corporate tax deductions. However, depreciation, in addition to investment tax credits, can also be served as non-debt tax shields to reduce the corporate tax for these firms; therefore, these non-debt tax shields are considered as an alternative for the tax benefits of debt financing (DeAngelo and Masulis, 1980). As a result, public firms with greater non-debt tax deductions are less likely to choose debt for their external financing, because they have less incentives for the tax deducted benefits provided by debt (Wald, 1999).

Most of the existing literature also found a significant negative relationship between non-debt tax shields and leverage ratio (DeAngelo and Masulis, 1980; Wald, 1999; Deesomsak et al., 2004). For any prior studies that found a positive coefficient on depreciation and amortization (Bradley et al., 1984), one of the explanation is that because

their measurement does not include the amount of property, plant and equipment (PPE) in their regression models. Since these two independent variables are highly correlated, both variables need to be included in the regression model to segregate their effects (Wald, 1999). In this paper, the set of firm-specific independent variables does not include PPE variable. However, while the original regression model by Wald (1999) does not include tangibility variable, the tangibility ratio used in this paper can be considered as an alternative for PPE variable because these two variables are highly correlated, thus they should yield a similar effect on leverage.

4.3.1.5 Growth Opportunity (GROWTH)

In this paper, growth opportunity measures the growth of the book value of total assets and is calculated as below.

$$\text{Growth Opportunity (GROWTH)} = \% \text{change}(\text{Total Assets})$$

Theoretically, from the point of view of the static trade-off theory, growth opportunity is considered as a type of intangible assets, and public firms with higher growth opportunity are more flexible with their future investments. In order to avoid agency conflicts such as debt overhang or asset substitution that equally make equity holders behave sub-optimally, these firms have more incentives to use internal finance sources or equity to finance their investment projects, instead of seeking for external debt financing (Wald, 1999). Moreover, because of the agency conflicts mentioned above, the costs of borrowing for these high growth public firms tend to be higher than the costs for lower growth public firms. As a result, public firms with higher growth are more likely to prefer equity financing to debt financing.

Prior studies use different indicators to capture growth opportunity for public firms: five-year average of sales growth (Wald, 1999), market-to-book value of total assets (Deesomsak et al., 2004), or the percentage change in the book value of total assets (Titman et al., 1988). Despite of different measurements, they all found an inverse relationship between growth opportunity and leverage ratio.

4.3.1.6 Profitability (PROFIT)

In this paper, profitability measures a company's ability to generate revenue through its existing assets and is defined as the ratio of earnings before interest and tax (EBIT) to the book value of total assets. Profitability is calculated as below.

$$\text{Profitability (PROFIT)} = \frac{EBIT}{\text{Total Assets}}$$

Theoretically, from the point of view of the static trade-off theory, in order to utilize tax shield benefits, profitable public firms have more incentives to seek for debt financing compared to less profitable public firms. Furthermore, banks and debt suppliers in the market are inclined to lend to profitable firms because of the higher probability to redeem debts and lower risks of bankruptcy (Rajan et al., 1995). Therefore, profitability is expected to be positively correlated with leverage ratio.

On the other hand, from the point of view of the pecking order theory, in order to avoid information asymmetries issue between corporate insiders and outside investors, public firms in general prefer to finance their investments and operations from retained earnings first, then from debt financing and finally from issuing new equity to the market. Moreover, less profitable public firms probably will have less available earnings for retaining purpose, thus these firms have higher demand for external financing. As a result, unlike the static trade-off theory, the pecking order theory suggests that the profitability is negatively associated with leverage ratio. Most of the existing literature also found a significant relationship between these two variables (Booth et al., 2001; Deesomsak et al., 2004; Huang, 2006).

4.3.1.7 Liquidity (LIQ)

In this paper, liquidity measures how much assets that public firms could convert into cash to pay for their short-term debt obligations and is defined as the ratio of total current assets to total current liabilities. Liquidity is calculated as below.

$$\text{Liquidity (LIQ)} = \frac{\text{Depreciation} + \text{Amortization}}{\text{Total Assets}}$$

Theoretically, from the point of view of the pecking order theory, public firms with high liquidity have less incentives to borrow compared to public firms with low liquidity, because these firms could utilize their liquid assets for future investment opportunities as a trusted financial source. Moreover, managers could manipulate liquid assets in favor of shareholders against the interest of debt holders, which may increase the agency costs of debt and make debt financing become less preferred (Deesomsak et al., 2004). Thus, liquidity is expected to be negatively correlated with leverage ratio.

On the other hand, from the point of view of the static trade-off theory, public firms with high liquidity also face a lower risk of bankruptcy due to their ability to pay for their short-term debt obligations. This allows these public firms to utilize a higher level of leverage to take advantage of their lower default risk and their lower cost of debt compared to other

public firms. Therefore, unlike the pecking order theory, the static trade-off theory suggests that liquidity is positively associated with leverage ratio.

In practice, most of the existing literature found a negative relationship between liquidity and leverage ratio (Deesomsak et al., 2004; Eriotis et al., 2007), indicating that the effect of the pecking order theory may be stronger than the effect of the static trade-off theory.

4.3.1.8 Firm-specific Independent Variables Summary

Table 6 below provides a summary descriptive statistics of the set of firm-specific independent variables discussed earlier. As it can be seen from the figures that public firms in Sweden and Finland have a significantly lower amount of tangible assets compared to public firms in Norway and Denmark. It may be because there is an existing industrial effect on tangibility between public firms in different industry sectors, and a higher proportion of Swedish and Finnish listed firms operating in IT sector or other equivalent sectors that are less capital intensive leads to the average tangibility ratio in Sweden and Finland to be lower in comparison to the other two Nordic countries.

Theoretically, different industries have significant differences in terms of institutional characteristics, including business risk, the required amount of tangible assets for operations, growth prospects or corporate tax rate. Prior literature also demonstrated that the requirement of external finance by public firms varies across different industries (Huang, 2006; De Jong et al., 2008). For an example, public firms operating in an industry with greater growth opportunity are more likely to have a higher amount of potential investments, which lead to a lower level of debt in order to avoid agency problems. Another example is that public firms operating in IT industry tend to have large amount of intangible assets and insignificant amount of tangible assets compared to other industries; therefore, these firms are more likely to prefer equity financing to debt financing in order to avoid high costs of debt. Because the industry classification and capital structure decision are closely related to each other, in order to examine how industrial factors have their impacts on the leverage ratio, in this paper all public firms are classified into ten industrial sectors following the Global Industry Classification Standard (GICS). Table 7 below provides an overview of industrial classification across four Nordic countries. As it can be seen from the figures, the proportion of IT public firms is highest in Sweden and Finland, which is relevant to my aforementioned discussion that a low ratio of tangibility in Sweden and Finland may be caused by a high percentage of IT public firms and a low percentage of real estate firms.

Table 6: Descriptive Statistics of Firm-specific Independent Variables

Table 6 provides a descriptive statistics of firm-specific independent variables in 2004 – 2017 period. TANG (tangibility) is the ratio of fixed assets to total assets. SIZE (firm size) is the natural logarithm of total assets. RISK (business risk) is the absolute difference between the percentage change in EBIT and the mean of these changes. NDTS (Non-debt tax shields) is the ratio of depreciation and amortization to total assets. GROWTH (growth opportunity) is the percentage change of total assets. PROFIT (profitability) is the ratio of EBIT to total assets. LIQ (liquidity) is the ratio of current assets to current liabilities.

Country	TANG	SIZE	RISK	NDTS	GROWTH	PROFIT	LIQ
Denmark							
Mean	0.46	19.16	2.41	0.04	0.16	0.03	2.44
S.D	0.26	2.33	8.52	0.04	1.12	0.24	6.46
Min	0	11.08	0.00	-0.03	-0.99	-3.05	0.04
Max	0.99	24.79	137.01	0.30	24.67	0.51	157.56
Finland							
Mean	0.35	19.28	3.37	0.04	0.09	0.06	1.74
S.D	0.19	2.09	25.91	0.03	0.51	0.12	2.05
Min	0	13.41	0.00	0	-0.79	-2.14	0.56
Max	0.98	24.52	798.47	0.67	10.17	0.54	54.55
Norway							
Mean	0.51	19.27	2.28	0.05	0.39	-0.03	2.64
S.D	0.28	2.16	7.30	0.08	3.23	0.37	7.69
Min	0	11.57	0	0	-0.99	-5.44	0.04
Max	0.99	25.42	126.37	2.04	97.23	2.15	243.60
Sweden							
Mean	0.35	17.39	7.90	0.05	0.37	-0.05	2.90
S.D	0.26	2.55	109.94	0.22	2.14	0.42	10.55
Min	0	8.79	0	-0.02	-0.99	-14.87	0.01
Max	0.99	24.10	4877.76	9.36	50.61	3.65	329.94

Table 7: The Percentage of Public Firms Classified by Industrial Sectors across Nordic Countries

Table 7 provides the summary of percentage of public firms classified by industrial sectors across four Nordic countries including Denmark, Finland, Norway and Sweden. Industrial classification follows the standard classification of Global Industry Classification Standard (GICS) code.

Industrial Sector	Denmark	Finland	Norway	Sweden
Communication Services	9%	7%	4%	7%
Consumer Discretionary	9%	11%	4%	11%
Consumer Staples	9%	7%	7%	4%
Energy	3%	1%	33%	2%
Healthcare	17%	5%	5%	16%
Industrials	32%	36%	20%	27%
Information Technology	8%	22%	14%	19%
Materials	6%	8%	6%	8%
Real Estates	3%	1%	7%	4%
Utilities	5%	1%	2%	1%

Table 8 below provides a summary of the firm-specific independent variables, their measurements as well as the expected sign in relation to leverage ratio. These relationship have been discussed in the earlier sections.

Table 8: Summary of Firm-specific Independent Variables

Table 8 provides a summary measurement of firm-specific independent variables and their expected sign in relation to leverage ratio. The set of firm-specific independent variables consists of tangibility, firm size, business risk, non-debt tax shields, growth opportunity, profitability and liquidity.

Firm-specific factors	Indicators	Expected sign
Tangibility (TANG)	$\frac{\text{Fixed Assets}}{\text{Total Assets}}$	+
Firm size (SIZE)	$\ln(\text{Total Assets})$	+
Business risk (RISK)	$ \% \text{Growth(EBIT)} - \text{mean}(\% \text{Growth(EBIT)}) $	-
Non-debt tax shields (NDTS)	$\frac{\text{Depreciation} + \text{Amortization}}{\text{Total Assets}}$	-
Growth (GROWTH)	$\frac{\% \text{change}(\text{Total Assets})}{\text{EBIT}}$	-
Profitability (PROFIT)	$\frac{\text{EBIT}}{\text{Total Assets}}$	-
Liquidity (LIQ)	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$	-

Table 9 below provides the correlation matrix between dependent variable, which is long-term debt ratio (LEV), and firm-specific independent variables including tangibility (TANG), firm size (SIZE), non-debt tax shields (NDTS), growth opportunity (GROWTH), business risk (RISK), profitability (PROFIT) and liquidity (LIQ). Among the correlation coefficients, I find that the correlation coefficient between tangibility and firm size is quite high at around 45%. Other than that, most correlation coefficients are very small; thus, there is little concern about the collinearity between firm-specific independent variables.

Table 9: Correlation Matrix

Table 9 provides the correlation matrix between dependent variable, which is long-term debt ratio (LEV), and firm-specific independent variables including tangibility (TANG), firm size (SIZE), non-debt tax shields (NDTS), growth opportunity (GROWTH), business risk (RISK), profitability (PROFIT) and liquidity (LIQ).

	LEV	TANG	SIZE	NDTS	LIQ	GROWTH	PROFIT	RISK
LEV	1.000							
TANG	0.452	1.000						
SIZE	0.385	0.221	1.000					
NDTS	-0.025	0.071	-0.116	1.000				
LIQ	-0.088	-0.075	-0.120	-0.029	1.000			
GROWTH	-0.011	-0.005	-0.038	-0.036	0.054	1.000		
PROFIT	0.085	-0.006	0.354	-0.332	-0.022	0.009	1.000	
RISK	-0.007	0.017	-0.051	0.091	0.037	0.078	-0.008	1.000

4.3.2 Country-specific Independent Variables

Prior literature presented that public firms in various institutional characteristics have diverse financing decisions, since external environment is one of the most dominant factors to either encourage or constrain how firms choose their external financing sources. While external environment includes both country-specific factors and industry-specific factors, most of the existing empirical studies found a significant correlation between country-specific factors and the leverage ratio (Booth et al., 2001; Deesomsak et al., 2004; De Jong

et al., 2008). Furthermore, after the financial crisis in 2008, the financial system as a whole as well as the external financial environment has been reformed and enforced with more policies and stricter legal regulations. Thus, institutional and country-specific determinants are also helpful to understand more thoroughly the issue of corporate finance behaviors, especially in the Nordic context as the scope of this paper.

While there is a significant amount of existing literature studying the impact of country-specific factors on leverage, the most commonly adopted country-factors include the development of the banking industry in relation to the financial market, GDP growth rate, the development of the stock market, the development of the bond market and inflation rate. Some prior empirical studies also included legal system variable by defining an indicator variable that takes a value of 1 if the country's legal system is based on common law, and 0 otherwise (La Porta et al., 1998; Deesomsak et al., 2004; Fan et al., 2012). However, in this paper I do not adopt this variable into the regression model mainly because all four countries in the full sample set are using the same civil law system. Instead, five proxies are selected in the aspect of country-specific factors, including the development of the banking industry, the development of the stock market and the bond market, GDP growth rate and inflation rate. These variables are collected from the primary source which is World Development Indicators and Financial Structure Database of the World Bank.

Theoretically, different levels of the development of the banking industry may have impact on the accessibility to external financing, which helps to explain the difference in the level of leverage adopted by public firms in different countries. On the other hand, the development of the stock market may help to explain why public firms in one country prefer equity financing to debt financing than public firms in other countries. Inflation is another factor that may have impact on the choice of capital structure: from the lender's perspective, high inflation discourages the lender to provide long-term debt as debt contracts are generally in nominal terms and high inflation makes the lender become worse-off. However, from the corporate's perspective, the cost of debt is lowered in case of high inflation, thus the demand for corporate bonds increases in relation to the increase in inflation.

4.3.2.1 Development of the Banking Industry (BANK)

In this paper, development of the banking industry measures the size of the domestic banking industry and is defined as the ratio of demand, time and saving deposits in deposit money banks to GDP. The ratio is calculated as below.

$$\text{Bank Development (BANK)} = \frac{\text{Deposit Money Banks}}{\text{GDP}}$$

Theoretically, size of the banking industry may have impact on the choice of capital structure for public firms, as developed and mature banking industry could help these firms to get more accessibility to external financing, and thus encourage them to adopt a higher level of debt because of the lower cost of capital. Therefore, the development of the banking industry is expected to have a positive correlation with leverage. Existing literature also found a significant positive relationship between these two variables (Rajan and Zingales, 1995). However, the authors also noted that the relative importance of banking industry is less indicative of the difference in corporate leverage than in the relative amounts of private financing such as bank loans and arms-length financing through open market securities (Rajan and Zingales, 1995; Booth et al., 2001).

4.3.2.2 Development of the Stock Market (STOCK)

In this paper, development of the stock market is defined as the ratio of the stock market capitalization to GDP and is calculated as below.

$$\text{Stock Development (STOCK)} = \frac{\text{Total Value Stock Market Capitalization}}{\text{GDP}}$$

Theoretically, between developed and developing markets, stock market in developed countries tends to be larger in trading volume with higher liquidity and smaller volatility than the stock market in developing countries. More importantly, during bearish period, developed stock market is probably more stable than emerging stock markets. Therefore, public firms listed in developed stock markets may prefer equity financing due to the transparent and developed stock market environment; thus, stock market development is expected to have a negative relationship with leverage ratio. In practice, prior studies also found a significant negative correlation between stock market development and leverage ratio (Booth et al., 2001).

4.3.2.3 Development of the Bond Market (BOND)

In this paper, development of the bond market is defined as the ratio of the total bond market capitalization to GDP, in which bond market capitalization is the sum of private and public bond market and is calculated below.

$$\text{Bond Development (BOND)} = \frac{\text{Public Bond Capitalization} + \text{Private Bond Capitalization}}{\text{GDP}}$$

Theoretically, developed bond market could facilitate issuing more trading bonds and thus, increase the leverage level of public firms. More interestingly, prior studies has found a counter-intuitive negative effect of the development of the bond market on leverage ratio (De Jong et al., 2008). It may be because a strong combination of various sources of

financing, including both developed stock market and bond market, could provide a more efficient basis for public firms' financing decision; and for public firms in a country with relatively weaker bond market, they are more likely to seek external financing from banks or from private sectors, instead of equity issues.

4.3.2.4 GDP Growth Rate (GDPGROWTH)

In this paper, GDP growth rate is defined as the annual real GDP growth rate in each country and is a common macroeconomic indicator for the overall economy performance in such country. The GDP growth rate is calculated as below.

$$GDP\ Growth\ Rate\ (GDPGROWTH) = \% \ change\ (GDP)$$

In practice, prior empirical studies have found very mixed results for the correlation between the GDP growth rate and leverage ratio of public firms: Booth et al. (2001) found a positive relationship between the two variables in developing countries over the period from 1980 to 1990; on the other hand, Gajurel (2005) found a negative relationship between the GDP growth rate and debt ratio. One of the reasons for the mixed results in previous studies is that for public firms operating in high GDP growth rate markets, these firms have less incentives to adopt a large amount of external financing because the economy is already providing sufficient investment opportunities and therefore, they tend to adopt a lower level of leverage. On the other hand, the positive correlation between GDP growth rate and leverage ratio could be seen in competitive markets where concentration level is low. In this case, public firms may require more external financing for their operating activities to keep up to their competitors in a high growth environment.

4.3.2.5 Inflation Rate (INFLATION)

In prior studies, inflation rate is a common macroeconomic indicator to examine the impact of price level on debt and equity level of public firms. However, these studies have found mixed results for the relationship between inflation rate and leverage ratio. Theoretically, from the lender's perspective, high inflation rate would discourage lenders to provide long-term debt to public firms as debt contracts are generally fixed in nominal terms and the high inflation rate would make these lenders become worse-off. However, from the borrower's perspective, high inflation rate would lower the cost of debt for public firms, therefore, demand for corporate bonds is more likely to increase when inflation rate is high.

4.3.2.6 Country-specific Independent Variables Summary

Table 10 below provides a summary of the average value of country-specific factors across four Nordic countries. As it can be seen from the figures, across four Nordic countries, Sweden and Denmark have a more developed financial systems including banks, stock market and bond market, on the other hand, Finland has the least developed bond market among four countries.

Table 10: The Average Value of Country-specific Independent Variables across countries

Table 10 provides a summary of average value of different country-specific factors across Denmark, Finland, Norway and Sweden in the period 2004 – 2017. Data is collected primarily from World Development Indicators and Financial Structure Database of the World Bank.

Country-specific Factors	Denmark	Finland	Norway	Sweden
<i>Development of Banking Industry (BANK)</i>	189.25%	87.80%	109.54%	125.33%
<i>Development of Stock Market (STOCK)</i>	63.78%	80.42%	55.59%	99.32%
<i>Development of Bond Market (BOND)</i>	201.46%	35.75%	46.65%	56.29%
<i>GDP Growth Rate (GDPGROWTH)</i>	1.16%	1.03%	1.65%	2.27%
<i>Inflation (INFLATION)</i>	1.57%	1.46%	1.94%	1.06%

Table 11 below provides a summary of the country-specific independent variables' measurement, and their expected sign in relation to leverage ratio for public firms as discussed in the earlier sections.

Table 11: Summary of Country-specific Independent Variables

Table 11 provides a summary measurement of country-specific independent variables and their expected sign in relation to leverage. The set of country-specific independent variables consists of the development of the banking industry, the development of the stock market, the development of the bond market, GDP growth rate and inflation rate.

Country-specific factors	Indicators	Expected sign
<i>Development of Banking Industry (BANK)</i>	Deposit Money Bank Assets to GDP (%), measured as claims on domestic real non-financial sector by deposit money banks as a share of GDP	+
<i>Development of Stock Market (STOCK)</i>	Stock market capitalization to GDP (%), measured as the total value of listed shares to GDP	-
<i>Development of Bond Market (BOND)</i>	Sum of private bond market and public bond market capitalization to GDP	+/-
<i>GDP Growth Rate (GDPGROWTH)</i>	Annual real GDP growth rate	+/-
<i>Inflation (INFLATION)</i>	Annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole	+/-

4.4 Hypothesis

In the previous sections, the relationship between two sets of firm-specific and country-specific factors and the leverage ratio has been discussed from both theoretical and practical points of view. In this paper, the following hypothesis will be tested and the empirical results will be further discussed:

4.4.1 Firm-specific Determinants Hypothesis

- H1.1: Tangibility is positively correlated with leverage.
- H1.2: Firm size is positively correlated with leverage.
- H1.3: Business risk is negatively correlated with leverage.
- H1.4: Non-debt tax shields is negatively correlated with leverage.
- H1.5: Growth opportunity is negatively correlated with leverage.
- H1.6: Profitability is negatively correlated with leverage.
- H1.7: Liquidity is negatively correlated with leverage.

4.4.2 Country-specific Determinants Hypothesis

- H2.1: The development of the banking industry is positively correlated with leverage.
- H2.2: The development of the stock market is negatively correlated with leverage.
- H2.3: The development of the bond market is positively correlated with leverage.
- H2.4: GDP growth rate is negatively correlated with leverage.
- H2.5: Inflation is positively correlated with leverage.

5 Empirical Results

While several of existing empirical studies have examined the effect of firm-specific and country-specific determinants on capital structure for public firms, most often these studies primarily focused on the U.S market and other common developed markets (Deesomsak et al., 2004; De Jong et al., 2008; Fan et al., 2012). On the other hand, there is still very little empirical studies conducted in the Nordic market: even existing literature that included broader data set of these Nordic countries have found mixed results for the determinants of the capital structure in both firm-level and country-level aspects (De Jong et al., 2008). Thus, the aim of this paper is to extend the existing literature on this topic in the Nordic region by providing an empirical analysis of the impact of firm-specific and country-specific factors on the capital structure decisions using fixed-effect regression.

In addition, this chapter also provides additional analysis on the impact industrial factors on the determinants of the capital structure for public firms by decomposing the pooled data set into sub-categories of different industries following the Global Industry Classification Standard (GICS). Furthermore, this paper also examines the effect of the financial crisis 2008 to the determinants of capital structure by decomposing the data set into pre-crisis (before 2008) and post-crisis (after 2008) period.

5.1 The Determinants of Firm-Specific Factors on Leverage

In order to identify the potential heteroscedasticity in the sample set, I employ the Breusch-Pagan test and the test result p-value for seven parameters is zero, which rejects the null hypothesis that there is no heteroscedasticity in the sample set. In addition, I conduct the Durbin-Wu-Hausman test (or the so-called Hausman specification test) to differentiate fixed effect and random effect model. The p-value result of the Hausman specification test is zero, which also rejects the null hypothesis that there is no correlation between firms' non-observable individual effects and the independent variables. Thus, the fixed effect model is preferred at any conventional significance level.

Table 12 below provides a summary of estimation results using fixed effect model for the pooled sample set, as well as regression results for individual country in the Nordic region.

Table 12: Summary of Regression Estimation using Fixed Effect model

Table 12 provides a summary of estimation results using fixed effect model for the following regression:

$LEV_{i,t} = \alpha_i + \beta_1 TANG_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 NDT S_{i,t} + \beta_4 RISK_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 PROFIT_{i,t} + \beta_7 LIQ_{i,t} + u_{i,t}$,
 whereas LEV is the long-term debt ratio, TANG is the tangibility, SIZE is the firm size, NDT S is the non-debt tax shields, RISK is the business risk, GROWTH is the growth opportunity, PROFIT is the profitability, LIQ is the liquidity. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Variables	Pooled	Denmark	Finland	Norway	Sweden
<i>TANG</i>	0.114*** (0.012)	0.253*** (0.045)	0.009 (0.042)	0.103*** (0.031)	0.087*** (0.015)
<i>SIZE</i>	0.019*** (0.003)	0.033*** (0.011)	0.002 (0.008)	0.035*** (0.005)	0.009*** (0.003)
<i>NDTS</i>	-0.031** (0.011)	0.369 (0.247)	-0.098 (0.125)	0.059 (0.064)	-0.032*** (0.010)
<i>LIQ</i>	-0.001 (0.000)	0.001 (0.002)	-0.005** (0.002)	0.000 (0.000)	-0.000 (0.000)
<i>GROWTH</i>	0.001 (0.001)	0.016** (0.007)	-0.012* (0.007)	0.002* (0.001)	-0.001 (0.001)
<i>PROFIT</i>	-0.030*** (0.006)	-0.071* (0.036)	-0.267*** (0.041)	-0.047*** (0.013)	-0.019*** (0.006)
<i>RISK</i>	-0.000** (0.000)	0.000 (0.001)	0.000 (0.000)	-0.001* (0.001)	-0.001** (0.001)
<i>Constant</i>	-0.230*** (0.046)	-0.587*** (0.202)	0.157 (0.156)	-0.518*** (0.103)	-0.078 (0.055)
<i>Observations</i>	5,744	668	1,059	1,453	2,564
<i>R-squared</i>	0.271	0.102	0.058	0.057	0.027

5.1.1 Tangibility (TANG)

Tangibility is expected to have a positive correlation with leverage ratio for public firms. The result of the fixed effect model shows that Tangibility is positively related to long-term debt ratio for all countries in the sample set except for Finland. More interestingly, this positive relationship is statistically significant even at 1% significant level. The result is consistent with the static trade-off theory that public firms with higher tangibility level are more likely to use more leverage because of lower costs of debt; meanwhile, the insignificant result of tangibility for the case of Finnish listed firms is probably due to the close relationship of Finnish public firms and lenders, which reduces demand for required collateral for debt financing.

For the case of Sweden, although they have a higher portion of public firms operating in Information Technology industry in comparison to other Nordic countries, the result shows that there is still a significant positive relationship between tangibility and leverage for public firms in Sweden. One explanation could be that the portion of Swedish listed firms operating in Industrial industry is also very high, in which these firms are more likely to use their tangible assets as collateral to diminish the costs of debt. The positive correlation

between tangibility and leverage is consistent with previous empirical studies (Rajan and Zingales, 1995; De Jong et al., 2008; Fan et al., 2012).

5.1.2 Firm Size (SIZE)

Firm size is expected to have a significant positive relation with leverage ratio for public firms following the empirical results of existing studies (Rajan and Zingales, 1995; Deesomsak et al., 2004; De Jong et al., 2008). The result of the fixed effect model shows that firm size is positively correlated to long-term debt ratio for all countries, except for Finland, although the pooled data set also yields a positive relationship for the two variables. This positive correlation is consistent with the static trade-off theory and information asymmetries, in which large public firms tend to be more diversified and thus they have a lower probability of bankruptcy and financial distress. On the other hand, smaller firms are more likely to face a higher cost for obtaining debt financing. The positive correlation is also consistent with previous empirical studies (Titman et al., 1988; Wald, 1999).

5.1.3 Business Risk (RISK)

As discussed in the previous sections, the business risk is expected to have a negative relationship with leverage ratio for public firms. The result of the fixed effect model shows that earnings volatility is negatively correlated to leverage ratio for the pooled data set and for Norway and Sweden. There is no significant relationship between the two variables for Finland and Denmark. Theoretically, the static trade-off theory and bankruptcy costs suggested that public firms with volatile earnings have higher probability of bankruptcy and financial distress, as these firms may not be able to fulfil their debt commitments. Therefore, a high volatility in earnings reduces firms' capacity for debt financing and the business risk is expected to be negatively correlated with leverage.

In practice, prior literature showed mixed results for the relationship between leverage ratio and the business risk: earnings volatility appears to have no significant effect on leverage in all four Asian countries in the sample, including Thailand, Malaysia, Singapore and Australia (Deesomsak et al., 2004); on the other hand, leverage ratio is positively correlated with the business risk in Jordan, and vice versa in Korea (Booth et al., 2001). One of the reasons for the positive relationship found in previous studies could be because firms' capacity to service their debt obligation is far beyond their current borrowing level; thus, these firms may ignore the volatility of earnings because of the low risk of financial distress.

Booth et al. (2001) also found a positive correlation in Jordan, while Deesomsak et al. (2004) found a similar result in Australia.

5.1.4 Growth Opportunity (GROWTH)

Theoretically, growth opportunity is expected to have a negative relationship with leverage ratio, as public firms with higher growth are more likely to prefer equity financing to debt financing due to agency conflicts. However, in practice, the result of the fixed effect model shows that Finland is the only country which has a significant inverse correlation between growth opportunity and long-term debt ratio, while there is a positive correlation for Denmark and there is no significant relationship for Sweden and Norway. The negative relationship for public firms in Finland is consistent with the static trade-off theory and agency theory, in which firms with high growth opportunities are more likely to use internal sources of finance or equity to finance their investment projects instead of seeking external debt to avoid agency conflicts (Wald, 1999). Prior empirical studies also found a significant negative relationship between growth opportunity and leverage ratio (Wald, 1999; Deesomsak et al., 2004; De Jong et al., 2008).

5.1.5 Profitability (PROFIT)

Theoretically, profitability is expected to have a positive relationship with leverage ratio for public firms. However, the result of the fixed effect model shows the inverse correlation between the profitability and long-term debt ratio for all four countries. This result rejects the static trade-off theory and supports the pecking order theory and information asymmetries, in which firms in Nordic region generally prefer to finance their investment from retained earnings and debts to equity. To some extent, this result also indicates that the effect of the static trade-off theory is weaker than the effect of the pecking order theory and information asymmetries. Prior empirical studies also found a significant negative relationship between profitability and leverage (Booth et al., 2001; Deesomsak et al., 2004; Huang, 2006).

5.1.6 Non-debt Tax Shields (NDTS)

Theoretically, non-debt tax shields is expected to have a negative relationship with leverage ratio, as public firms with greater non-debt tax deductions are less likely to choose debt for their external financing, because they have less incentives for the tax deducted benefits provided by debt. While prior empirical studies found an inverse correlation (DeAngelo and Masulis, 1980; Wald, 1999; Deesomsak et al., 2004), the result of the fixed effect model

shows no significant correlation between non-debt tax shields and long-term debt ratio for most of Nordic countries, except in Sweden and in the pooled data set there is a negative correlation between the two variables. This result indicates that the effect from the point of view of the static trade-off theory may be not strong enough for the non-debt tax shields to have a significant impacts on firms' decision on capital structure in the Nordic region, with Sweden is the only exception.

5.1.7 Liquidity (LIQ)

Theoretically, liquidity is expected to have a negative relationship with leverage ratio, as public firms with high liquidity have less incentives to borrow compared to public firms with low liquidity, because these firms could utilize their liquid assets for future investment opportunities as a trusted financial source. While existing literature found a negative correlation (Deesomsak et al., 2004; Eriotis et al., 2007), the result of the fixed effect model shows no significant estimation for most of Nordic countries, except for Finland. This result indicates that neither the effect of pecking order theory nor the effect of static trade-off theory is strong enough for liquidity to have impact on capital structure decision, or it may because these two effects cancel out each other.

5.1.8 Industry Effect on Firm-specific Determinants

Table 13 below provides a summary of estimation results using fixed effect regression model for public firms in the Nordic region classified under different industrial sectors, following GICS code. As it can be seen from the figures, there is no significant correlation between tangibility and leverage ratio for public firms operating in Information Technology sector, which indicates the aforementioned suggestion that firms operating in a less tangible-intensive industry may behave differently from the pecking order theory, as these firms prefer equity issue if they need external financing.

In addition, non-debt tax shields is also positively correlated with leverage for Consumer Staples, Real Estate and Utilities sector, while it yields a significant negative association for Energy and Material sector. This result strongly indicates the existence of industrial factor across listed firms in the Nordic region. Prior empirical studies also found the significant effect of industrial factor on the capital structure decision (Huang, 2006; De Jong et al., 2008).

Table 13: Model Estimation using Fixed Effect model with Industrial Classification

Table 13 provides a summary of estimation results using fixed effect model for the following regression:

$LEV_{i,t} = \alpha_i + \beta_1 TANG_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 NDTs_{i,t} + \beta_4 RISK_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 PROFIT_{i,t} + \beta_7 LIQ_{i,t} + u_{i,t}$, whereas LEV is the long-term debt ratio, TANG is the tangibility, SIZE is the firm size, NDTs is the non-debt tax shields, RISK is the business risk, GROWTH is the growth opportunity, PROFIT is the profitability, LIQ is the liquidity. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Variables	Communication Services	Consumer Discretionary	Consumer Staples	Energy	Healthcare	Industrials	Information Technology	Materials	Real Estate	Utilities
<i>TANG</i>	0.198*** (0.047)	0.116** (0.055)	-0.086 (0.057)	0.096* (0.055)	0.099*** (0.028)	0.113*** (0.026)	-0.011 (0.027)	0.112** (0.055)	0.166*** (0.054)	-0.012 (0.075)
<i>SIZE</i>	0.013 (0.009)	0.029*** (0.008)	0.001 (0.010)	0.052*** (0.010)	-0.006 (0.007)	0.027*** (0.005)	0.010** (0.005)	-0.021* (0.012)	0.062*** (0.015)	0.046** (0.019)
<i>NDTS</i>	0.008 (0.056)	0.043 (0.204)	1.201*** (0.119)	-0.213* (0.121)	0.021 (0.060)	-0.032 (0.073)	0.098 (0.075)	-0.046*** (0.013)	0.700** (0.346)	2.196*** (0.764)
<i>LIQ</i>	0.007* (0.004)	0.000 (0.004)	0.000 (0.003)	0.001 (0.002)	-0.001 (0.001)	-0.001 (0.002)	-0.000 (0.000)	-0.002* (0.002)	0.000 (0.002)	0.000 (0.001)
<i>GROWTH</i>	0.003 (0.006)	-0.001 (0.002)	0.008* (0.005)	0.002 (0.001)	-0.008** (0.003)	0.007* (0.004)	0.006 (0.004)	-0.005** (0.003)	0.015* (0.010)	-0.001 (0.006)
<i>PROFIT</i>	-0.055 (0.039)	-0.016 (0.019)	0.049 (0.036)	-0.084** (0.039)	0.055*** (0.021)	-0.067*** (0.016)	-0.042*** (0.011)	0.021 (0.046)	0.114 (0.128)	0.067 (0.152)
<i>RISK</i>	-0.000 (0.000)	-0.001 (0.000)	-0.002* (0.001)	-0.001 (0.000)	-0.000 (0.001)	-0.000 (0.000)	-0.001 (0.000)	-0.001* (0.000)	-0.002 (0.005)	0.001 (0.002)
<i>Constant</i>	-0.197 (0.167)	-0.438*** (0.166)	0.144 (0.204)	-0.814*** (0.188)	0.158 (0.119)	-0.377*** (0.099)	-0.110 (0.086)	0.509** (0.227)	-0.981*** (0.286)	-0.746* (0.392)
<i>Observations</i>	393	492	336	558	590	1,643	1,012	423	215	82
<i>R-squared</i>	0.059	0.033	0.299	0.090	0.063	0.043	0.022	0.071	0.225	0.218

5.2 The Determinants of Country-Specific Factors on Leverage

Table 14 provides the estimation results using pooled OLS model with country dummy variables for public listed firms in Nordic region to examine the effect of country-specific factors on capital structure decision. Besides firm-specific variables, additional country-specific variables included in the OLS model consists of the development of the banking industry (BANK), the development of the stock market (STOCK), the development of the bond market (BOND), GDP growth rate (GDPGROWTH) and inflation rate (INFLATION).

The development of the stock market is expected to have an inverse relationship with long-term debt ratio. The result of the OLS model also shows the significant negative correlation between the stock market development and leverage ratio for public firms in the Nordic region. This result could be explained by the fact that as the stock market becomes more developed, it also becomes larger in market value, trading volume, and liquidity. Moreover, public firms in countries with developed stock market will have more incentives to issue equities instead of debt financing. Therefore, the development of the stock market is more likely to have a significant influence on the capital structure choice of public firms. This result is also consistent with the findings in previous studies (Booth et al., 2001; Deesomsak et al., 2004).

GDP growth rate is expected to have a mixed relationship with long-term debt ratio for public firms. The result of the OLS model, however, shows a significant inverse correlation between the GDP growth rate and leverage ratio. As discussed earlier, for firms operating in high GDP growth rate environment, they may find less incentives to adopt a large amount of external financing because of large economy-wide opportunities, thus they tend to adopt a lower level of leverage and lead to a negative relationship between these two variables. Although this result contradicts with Booth et al. (2001), the difference in result might be because Booth et al. examined these impacts by using a totally different set of developing countries. On the other hand, the positive relationship between GDP growth rate and leverage ratio is also found in some of the prior empirical studies (Gajurel, 2005).

Similar to the GDP growth rate, inflation rate is also expected to have a mixed effect on leverage. However, the result of the OLS model shows that there is no significant relationship between the inflation rate and long-term debt ratio for public firms in the Nordic region. As discussed earlier, high inflation rate makes the cost of debt financing become lower, thus the demand for debt financing increases in relation to the increase in inflation rate. However, high inflation rate also discourage lenders to provide long-term debt to public

firms as debt contracts are generally fixed in nominal terms and the high inflation rate would make these lenders become worse-off. One of the reasons for this result is may be because these two effects from the lenders and the borrowers have canceled out each other.

Table 14: Model Estimation using OLS model with Country-Specific Factors

Table 14 provides the estimation results using OLS model for the following regression:

$LEV_{i,t} = \alpha_i + \beta_1 TANG_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 NDTs_{i,t} + \beta_4 RISK_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 PROFIT_{i,t} + \beta_7 LIQ_{i,t} + \beta_8 BANK_{i,t} + \beta_9 STOCK_{i,t} + \beta_{10} BOND_{i,t} + \beta_{11} GDPGROWTH_{i,t} + \beta_{12} INFLATION_{i,t} + \beta_{13} FINLANDDUM_{i,t} + \beta_{14} NORWAYDUM_{i,t} + \beta_{15} SWEDENDUM_{i,t} + u_{i,t}$, whereas LEV is the long-term debt ratio, TANG is the tangibility, SIZE is the firm size, NDTs is the non-debt tax shields, RISK is the business risk, GROWTH is the growth opportunity, PROFIT is the profitability, LIQ is the liquidity, BANK is the bank development, STOCK is the development of the stock market, BOND is the development of the bond market, GDPGROWTH is the GDP growth rate, INFLATION is the inflation rate, whereas FINLANDDUM, NORWAYDUM, SWEDENDUM are country dummies. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Variables	LEV
<i>TANG</i>	0.265*** (0.010)
<i>SIZE</i>	0.018*** (0.001)
<i>NDTS</i>	-0.069** (0.034)
<i>LIQ</i>	-0.003*** (0.000)
<i>GROWTH</i>	-0.000 (0.001)
<i>PROFIT</i>	-0.022* (0.009)
<i>RISK</i>	0.0000 (0.000)
<i>BANK</i>	-0.047 (0.031)
<i>STOCK</i>	-0.0128*** (0.0139)
<i>BOND</i>	0.0267 (0.025)
<i>GDPGROWTH</i>	-0.334** (0.124)
<i>INFLATION</i>	0.304 (0.270)
<i>FINLANDDUM</i>	0.0770*** (0.0264)
<i>NORWAYDUM</i>	0.0863*** (0.0269)
<i>SWEDENDUM</i>	0.0663*** (0.0222)
<i>Constant</i>	-0.260*** (0.056)
<i>Observations</i>	3,450
<i>R-squared</i>	0.324

More importantly, the result of the OLS model shows that the development of the banking industry and the development of the bond market have no significant impact on the capital structure decision for public firms in the Nordic region. While theories suggest that

the development of the bond market should lead to an increase in the leverage ratio, this result indicates that changes in bond market have little impact on the capital structure choice for public firms in the Nordic region and instead these firms rely more on other financial options such as corporate bonds and bank loans.

On the other hand, the insignificant correlation between the development of the banking industry and leverage also indicates that between corporate bonds and bank loans, public firms may prefer corporate bonds to bank loans. Furthermore, the result of the country dummy variables indicate that country-specific factors have an impact on long-term debt ratio as the results for all three dummy variables are significant at 1% significance level.

5.3 Robustness Test

In this section, I will test the effect of financial crisis in 2008 on firm-specific determinants of capital structure for public firms in the Nordic region. In order to test the effect, I further divide the pooled data set into two sub-samples: before- and after-crisis. Table 15 below provides a summary of estimation results for these two sub-samples using fixed effect regression. As it can be seen from the table, the impacts of firm-specific determinants on the capital structure are different between pre-crisis and post-crisis period. Tangibility and firm size have a significant positive relationship with long-term debt ratio, regardless whether in pre-crisis or post-crisis period. More surprisingly, there is no impact of financial crisis on liquidity for public firms in the Nordic region on leverage ratio, as the result shows no significant correlation between liquidity and long-term debt ratio.

For other firm-specific determinants, the result clearly indicates the existence of the impact of financial crisis on the effects of determinants on capital structure for public firms in the Nordic region. Non-debt tax shields have a significant negative relationship with the leverage ratio after the financial crisis, although before the crisis there is no significant correlation between the two variables. On the other hand, growth opportunity have a significant positive relationship with the leverage ratio before the financial crisis; however, after the crisis, growth opportunity shows insignificant correlation with the long-term debt ratio.

Table 15: Model Estimation using Fixed Effect model Before and After Financial Crisis

Table 15 provides a summary of estimation results using fixed effect model for two sub-samples, before- and after- financial crisis 2008, for the following regression:

$LEV_{i,t} = \alpha_i + \beta_1 TANG_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 NDTs_{i,t} + \beta_4 RISK_{i,t} + \beta_5 GROWTH_{i,t} + \beta_6 PROFIT_{i,t} + \beta_7 LIQ_{i,t} + u_{i,t}$, whereas LEV is the long-term debt ratio, TANG is the tangibility, SIZE is the firm size, NDTs is the non-debt tax shields, RISK is the business risk, GROWTH is the growth opportunity, PROFIT is the profitability, LIQ is the liquidity. Standard errors are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Variables	Pooled pre-crisis	Denmark pre-crisis	Finland pre-crisis	Norway pre-crisis	Sweden pre-crisis	Pooled post-crisis	Denmark post-crisis	Finland post-crisis	Norway post-crisis	Sweden post-crisis
<i>TANG</i>	0.150*** (0.034)	0.191 (0.116)	0.236* (0.133)	0.023 (0.071)	0.151*** (0.042)	0.091*** (0.014)	0.293*** (0.048)	-0.066 (0.047)	0.062 (0.038)	0.073*** (0.016)
<i>SIZE</i>	0.013** (0.006)	0.017 (0.026)	0.028 (0.021)	0.016 (0.011)	-0.005 (0.008)	0.024*** (0.003)	0.038*** (0.010)	-0.000 (0.010)	0.041*** (0.007)	0.015*** (0.004)
<i>NDTS</i>	-0.001 (0.045)	1.647*** (0.476)	1.047 (0.657)	0.424** (0.164)	-0.045 (0.042)	-0.028** (0.011)	0.520* (0.307)	-0.135 (0.128)	0.020 (0.074)	-0.025** (0.010)
<i>LIQ</i>	-0.000 (0.001)	0.010 (0.007)	-0.000 (0.002)	-0.001 (0.002)	-0.002 (0.002)	-0.000 (0.000)	0.001 (0.002)	-0.011** (0.005)	0.000 (0.000)	-0.000 (0.000)
<i>GROWTH</i>	0.002** (0.000)	0.037*** (0.008)	0.0158 (0.012)	0.001 (0.001)	0.002 (0.004)	-0.001 (0.001)	0.036* (0.019)	-0.025*** (0.007)	-0.000 (0.002)	-0.001 (0.001)
<i>PROFIT</i>	-0.024 (0.023)	-0.010 (0.104)	-0.170 (0.114)	0.064 (0.045)	0.001 (0.029)	-0.029*** (0.005)	-0.084** (0.037)	-0.155*** (0.049)	-0.051*** (0.014)	-0.019*** (0.006)
<i>RISK</i>	-0.000*** (0.001)	-0.000 (0.001)	0.001 (0.000)	0.000 (0.001)	-0.000*** (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.000)	-0.001* (0.000)	0.001 (0.001)
<i>Constant</i>	-0.147 (0.115)	-0.339 (0.516)	-0.500 (0.418)	-0.128 (0.221)	0.142 (0.144)	-0.342*** (0.060)	-0.709*** (0.267)	0.221 (0.203)	-0.620*** (0.134)	-0.197*** (0.074)
<i>Observations</i>	1,226	138	274	346	468	4,518	530	785	1,107	2,096
<i>R-squared</i>	0.056	0.370	0.093	0.062	0.114	0.029	0.140	0.044	0.048	0.023

6 Conclusions

The lack of comparative studies on capital structure decision and the dynamic economic and financial environment of Nordic countries are my main motivation for choosing this topic for my master's thesis. Even existing empirical studies most often yield mixed results for the relationship of both firm-specific and country-specific determinants on the capital structure in different regions, thus it is very important to examine these effects more closely in the Nordic region as public firms operating in different areas are more likely to behave differently and even in a very unique way.

This paper examines the effect of firm-specific and country-specific determinants on the capital structure choice of firms in four Nordic countries including Denmark, Finland, Norway and Sweden by providing three empirical studies examining different effects on capital structure. The first empirical study aimed to investigate the impact of firm-specific factors on the capital structure decision using fixed effect model. The second empirical study aimed to provide evidence on the role of industry effect on the capital structure decision using fixed effect model. The last empirical study aimed to provide evidence on the role of macroeconomic factors on leverage using OLS model. Furthermore, the effect of financial crisis in 2008 on firm-specific determinants of capital structure is examined in the robustness test using fixed effect model. In summary, the results support findings from existing empirical studies, even though there are some minor differences in the results of different countries or different industries, indicate the existence of both industrial effect and country effect.

The result of the investigation into firm-specific effects shows that tangibility and firm size have a significant positive relationship with long-term debt ratio for public firms in most of Nordic countries, except for Finland. On the other hand, profitability is negatively correlated with leverage ratio in all four countries; meanwhile, growth opportunity yields a mixed result: there is a significant negative relationship for Finnish public firms and a significant positive relationship for Danish public firms. Liquidity and Non-debt tax shields have no significant impact on leverage for most of Nordic countries, except for Finland in terms of liquidity and Sweden in terms of non-debt tax shields. Business risk shows a significant negative relationship with leverage ratio in Norway and Sweden. Moreover, by decomposing the sample set into different industrial categories, I find that there is evidence

for the existence of industrial effect on firm-specific determinants, as the impact of those determinants on leverage ratio is different in different sectors.

The result of the investigation into country-specific effects shows that GDP growth rate and the development of the stock market have a significant negative correlation with long-term debt ratio. On the other hand, the estimation results show that the development of the banking industry, the development of the bond market, and the inflation rate have no significant impact on capital structure decision for public firms in the Nordic region. These results may imply that Nordic firms in general prefer equity financing to debt financing, and when it comes to debt financing decision these firms prefer corporate bonds to bank loans.

This paper has provided new evidence on the effect of some firm-specific and country-specific determinants on the capital structure choice of firms in Nordic countries and thus helped to extend the empirical findings of existing studies on this topic. However, there are still some limitations to this paper.

The first limitation is that the proximity in geographical location as well as the similarity in macroeconomic factors lead to the exclusion of commonly adopted independent variables such as corruption and legal system dummy variable. These exclusions may lead to a significant difference in the relationship of independent variables in comparison to prior existing literature.

The second limitation is that this study from the beginning has excluded financial firms from the final sample set as I find that these financial firms have a distinct capital structure behavior due to their liquidity characteristic. This exclusion may yield a different estimation result in comparison to the sample set which fully includes financial firms. However, for these financial firms, separate analysis should be conducted and afterward compared to firms operating in other sector to gain a more thorough understanding of the determinants of capital structure.

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